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On the 10th of October the tail of the comet extended to a point in the line between β *Herculis* and η *Coronæ;* distance from β one-third of distance of η *Coronæ.*

Note from the Astronomer Royal to the Editor on the Approaching Conjunction of Venus and Jupiter.

"Adverting to Professor Wolfers' remark in the *Monthly Notices* for January 14, on the near approach of *Venus* and *Jupiter* on 1859, July 20, I will call your attention to the circumstance that this conjunction is fully predicted in the *Nautical Almanac*, 1859, page 508. The prediction stands there in the following form:—

July 20, $15^{h} 45^{m}$ ♀ ☌ ♃ …… ♀ 0° 1′ S.

" *Royal Observatory, Feb.* 9, 1859."

Description of an Improvement in the making of large Reflecting Telescopes with Silvered Glass Specula. By M. Leon Foucault.

(*Communicated by Mr. De La Rue.*)

At the meeting of the Academy of Sciences of February 1857, the author described a new system of telescopes, the speculum of which was made of glass silvered by Mr. Drayton's process. Mirrors, so constructed, upon their removal from the bath of silver, already possess the necessary brilliancy for being used in the telescope; but the brilliancy may be still further increased by spreading, with a piece of chamois leather, the pulverulent and non-adhering layer which partly hides the polishing of the silver-coating.

Objections have been advanced against telescopes of this construction, on the ground of the fragility of the metallic layer, but experience has proved them to be unfounded. In the outset of his labours it occurred to the author that he could not do better than apply all his attention to the obtaining of spherical surfaces, the only ones which are produced regularly by mechanical means. In endeavouring to ascertain and to correct all the defects which subsist in such surfaces, he succeeded in executing at pleasure all the ellipsoidal surfaces which establish the transition between the sphere itself and the paraboloid of revolution. As a preliminary to such labours he made himself acquainted with the various processes employed in the working of glass by practical experience in the workshop of M. Secretan, the well-known optician of Paris.

As soon as a piece of glass which was being worked out began to reflect the light to a focus it was submitted to a course of optical experiments, by means of which it was possible to find the real shape of the surface. In the course of these experiments the author became convinced that surfaces as formed by opticians acquire their real value only at the final period of the polishing. They further served to establish this unexpected result, that the mechanical processes actually used in arts and industrial pursuits do not realise the spherical surface with such a degree of approximation as to withstand optical test. This circumstance suggested to him the idea of retouching polished surfaces with the hand in those instances wherein there existed defects, and of modifying them by means of local corrections, until light showed them to be irreproachable.

" This operation, which is repugnant to practical men, answered better than one could have hoped. When attempted for the first time on a speculum of 36 centimètres (14 inches) in diameter, which exhibited a central eminence very prejudicial to the formation of images, it brought the surface back in a few hours to a figure which was sensibly spherical. Afterwards, by dint of several successive tests to which the surface was submitted, I established beyond doubt the fact that it is possible by such means to arrive at a true spherical surface. I then conceived the idea of realising the parabolic surface with the degree of approximation necessary for the application I had in view.

"The method employed in effecting this transformation of the surface of the sphere is founded on the direction which the aberrations follow in the different positions of the conjugate foci of a concave speculum.

" If the speculum be exactly spherical, a luminous point placed at the centre of curvature produces at that centre an image which is free from aberration. But when the luminous point approaches the principal focus, the image recedes and is surrounded by an image of aberration which increases with the distance.

" First, let us conceive that the luminous point undergoes only a very slight displacement, in order that the image formed in its vicinity exhibits only a slight aberration, or the first indications of such. The speculum may then be corrected by means of a polisher of a suitable form until the aberration disappears; and as the mirror was spherical it becomes now ellipsoidal by the duplication of the primitive centre in two corresponding foci at the places occupied by the luminous point and its image.

" This correction being made for a first distance of the two foci it would be easy to find the value of that distance. Upon bringing the luminous point nearer to the mirror, new aberrations would reappear, which in their turn might be corrected by a similar process, and then the ellipsoid to which the surface of the mirror belongs would be increased in length.

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"Pursuing the same course by a small quantity at a time the ellipsoid is lengthened progressively until it is transformed into a paraboloid of revolution, that is to say, until the mirror has acquired the property of reflecting light to an infinite distance without any perceptible aberration.

"This method was first applied to a mirror of 25 centimètres (9·8 inches) in diameter, and was carried out only to a certain limit, so that the instrument collected in one focus only the rays emitted from a distance of 10 mètres (32·8 feet). However it has been thought desirable to maintain the instrument in this condition, in order that it may undergo other experiments, which, upon being repeated on a limited space, would demonstrate in a most decisive way the efficacy of the reflexion of the rays by the whole surface.

"A second mirror of the same diameter, the figure of which has been corrected in such a way that it became almost parabolical, and formed in the tube of the telescope at the distance of 1 mètre (3·28 feet) an image free from aberration, of objects placed at an indefinite distance.

"A third mirror, the diameter of which was 33 centimètres (13 inches), and the focal length of which was 2^{m}·25 (8^{feet}·87), prepared like the others, above mentioned, with much care in Mr. Secretan's workshop, presented, just after being taken from the workman's hand, a figure of revolution well centred upon its axis, but which deviated very much from the figure of a sphere. Upon being subjected to a slight re-touching it was very much improved, and the parts which were most salient have completely disappeared. Subsequently a second retouching, effected in a very short time, gave to the mirror a parabolic figure, and upon being directed towards celestial objects it was found to perform correctly.

"Although a surface of glass reflects only $\frac{1}{20}$th part of the incidental light, it is not necessary to have the mirror silvered in order to become acquainted with the state of the surface. The light of a lamp transmitted towards the observer, by means of a partial reflexion upon the glass mirror, possesses sufficient intensity for exhibiting all the details which are interesting for the discovery of the formation of the focus. As for the asperities which modify the geometrical properties of curvature, they are in reality so infinitely small that a single rubbing of the polisher is sufficient to cause them to disappear, without the necessity of continuing the process too long. In the dimensions I have operated on until now it has taken me only six hours to retouch a whole surface; a few minutes suffice to exhibit a sensible change. This mode of attacking the substance of glass admits of the operation being suspended at any time, and definitively terminated as soon as it is thought that the real figure has been acquired. Then comes the silvering, which increases the reflecting power without the least alteration of curvature being apprehended."

The author then proceeds to explain a method imagined by him for ascertaining the limit of the optical power of the instrument. He concludes with the following account of a trial which he made with a mirror of 33 centimètres (13 inches) aperture, and 2·25 mètres (8^{feet}·865) focal length:—

"On the night of the 21st of July, under a pretty favourable condition of the atmosphere, we undertook an attentive examination of γ *Andromedæ*. This star (which, in refracting telescopes of 33 centimètres or less, is seen double, the principal star being of a yellow colour mixed with a little red, and the other a blue star of a greenish tint) is really triple, as Struve has shown with the Pulkowa refractor. The duplicity of the blue star is well known.

"During the whole night this feature of the double star remained doubtful; but at three o'clock in the morning, as the first rays of the sun were perceptible, the definition became very much improved; and upon applying a magnifying power of 600, the star was seen plainly divided into two small points very near each other.

"Two days afterwards, at the same hour, but with not so good definition, this observation was confirmed. Moreover, in order to guard against any imperfection which might attach to the instrument, a single star was observed, in order to ascertain if the image of the star was perfectly free from duplicity.

"An experienced observer took part in this examination. We have drawn on paper, separately and at sight, the same impressions; and afterwards, when the catalogue was consulted, we have succeeded in ascertaining that the positions were exact.

"It is, then, an established fact that the star γ *Andromedæ* was seen double with a parabolic mirror of silvered glass 13 inches in diameter and 8·865 focal length.

"These results, very satisfactory in themselves, also offer interest on account of the small expenditure which has sufficed to obtain them. Thanks to the liberal disposition, to the disinterestedness of the learned artist Mr. Secretan, who for the last two years has continued to place at my disposal all the mechanical resources of a great establishment, the expense of the process for obtaining them has been confined within such limits that a private individual would have borne them easily. I have no doubt that, by the expenditure of a sum of money comparable to what is usually laid out on astronomical instruments, it is possible to construct a telescope of comparatively moderate dimensions which would be capable of revealing regions of space hitherto inaccessible to vision."